

## PUBLIC PAGE

### QUARTERLY REPORT

#### Project WP#339: Structural Significance of Mechanical Damage

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**Background**

The primary objective of the project is to establish a detailed experimental database to support the development and validation of improved burst and fatigue strength models for assessing the interaction of mechanical damage with secondary features (gouges, corrosion, and welds). The use of this data to develop and validate mechanistic models will produce reliable tools to assess a wide range of mechanical damage forms, thereby increasing safety, reducing unnecessary maintenance, and supporting the improvement of pipeline standards and codes of practice.

**Progress in the Quarter**

GDF SUEZ created two new defects of type “Dents with Gouge” on recent pipes:

- **Defect 1.2.3** on Pipe 1 (grade X52) for fatigue test.
- **Defect 2.1.3** on Pipe 2 (grade X70) for fatigue test.

GDF SUEZ repeated the creation of **defects** 1.1.1 and 1.2.1, called now **1.1.1b** and **1.2.1b**. Defects 1.1.1 and 1.2.1 were unwillingly submitted to pressure variations.

For all these defects magnetic particle inspection was performed and **revealed for all defects created under these conditions the presence of cracks at the gouge surface.**

2D longitudinal and circumferential profiles of defects were deduced from 3D laser mapping. In particular, the profiles of three defects of type 2 for Pipe 1 and three defects of type 1 for Pipe 2 were well reproduced.

Metallographic investigation of defect 1.2.2 after burst test failure showed that a **majority of cracks (>85%) are shorter than the thickness of the hardened layer** produced by the tooth impact that created the gouge. This means that only a very limited number of cracks coalesce and eventually one grows through-wall leading to failure.

Micro-hardness measurements converted to strain by calibration indicated a **local strain level around 40% close to the gouge surface.**